

Customer Success Story

KBI Kieswerk & Baustoff-Industrie
Kern GmbH & Co. KG

Marked segment
Machine Building



Gravel Plant in Load-Dependent Operation

The Weingärtner system integrator has updated the entire electrical system for crushing and classification as part of the modernization of a crushing operation. Eaton automation and drive technology together with the Smart-Wire DT smart connection and communication system is being used to obtain optimum performance from load-based equipment.

Location:

Iffezheim, Germany

Challenge:

Modernization of the entire electrical system of a crushing operation.

Solution:

XP500 touch panel, XC202 and XC152 compact controllers, Galileo visualization software, DE1 variable speed starter, DA1 variable frequency drive, PKE motor-protective circuit breaker, SmartWire-DT.

Results:

Access to detailed data on the individual drives enables load-dependent operation and supports preventive maintenance and targeted fault diagnosis, contributing to increased system productivity.

"We were faced with the challenge of achieving a solution on a manageable budget that gives the operator the opportunity to have a detailed view of the installation and for operations to be adjusted based on utilization."

Philipp Fels, Weingärtner

Background

In Iffezheim, sand and gravel have been extracted from the dredging lake for over 100 years by means of floating grabs using wet cutting technology. Major customers include the pre-cast concrete, ready-mix concrete and asphalt industries. The excavated gravel is cleaned in several steps and sorted by size. The larger pieces are then submitted to a finishing stage - known as, crushing.

Three cone crushers crush up to 160 t/h of gross material in several stages. The equipment then sorts the material by size through several screening machines, and lastly it is washed. The result is high-quality 1/3, 2/5, 5/8 and 8/11 gravel fractions and high-quality 0/2 crushed sand, which is stored in silos. These materials are used primarily in asphalt and for specific chip applications.

Challenge

Crushed stone operations were based on conventional contactor technology in the past. An SPC was never used. The operator decided to make its automation and drive technology state-of-the-art and to increase plant productivity during the course of an extensive modernization. They hired Baden-Baden based Weingärtner GmbH (Weingärtner) for the project, a specialist in various areas including electrical installations, switchboard construction and automation and drive technology.

"We were faced with the challenge of achieving a solution on a manageable budget that gives the operator the opportunity to have a detailed view of the installation and for operations to be adjusted based on utilization," explains Philipp Fels, the Weingärtner manager responsible for this project. "In addition, the time constraints were significant, since the project only allowed us about four weeks during winter repairs to completely refurbish the electrical system." This meant that the control room and the control cabinets had to be pre-installed in a

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container and delivered with it. As a solution partner in Eaton's EMEA-wide network of application specialists, Weingärtner is familiar with the capabilities and strengths of the SmartWire-DT smart connection and communication system. Given the conditions involved, the Baden-Baden operation decided to handle the project using Eaton technology.

Solution

Designed by Weingärtner, the control center for the system was the XP500 Touch Panel, a user-friendly HMI solution with capacitive multi-touch technology distinguished by a thin, ventilation-free design and low space requirement. In the 21.5" version, the XP500 assumes the representation of the higher level processes in the system. A network of controls (XC202), which Weingärtner has programmed with Codesys 3.5, is used to manage processes. According to Fels, complete visualization of the facility could be implemented extremely easily and quickly using Eaton software, thanks to the new version 10.

Special attention was devoted to the drive technology in crushing operations, since it has a significant effect on the efficiency and productivity of the operation. Eaton's Power XL DE1 speed controller assumes motor control of the conveyor and dosing belts. They are simple to operate and are as reliable as a motor starter, while at the same time offering variable speed control capability as a frequency

converter. This presents the ideal solution for applications that only require limited functionality but variable speed. The DA1 Frequency Converter, known for its high motor control and modularity performance, is used for more demanding applications such as the screening machines, floodwater pumps, sand screws and screw feeders for dosing.

Furthermore, the facility is equipped with approximately 70 PKE motor protective circuit breakers with electronic wide-range over-load protection, enabling reliable and secure direct starting of the drive. With the SmartWire-DT smart connection system, all important components can be quickly and effectively wired without the need for control wiring, decentralized I/O level and cumbersome addressing. "Compared to conventional technology, we saved about 30% of the time for wiring in the design of the control cabinets," says Fels. So together with PKE-based starter motor combinations, SmartWire-DT provides another decided advantage: All switching states and status reports, which previously required the complex installation of additional devices, can be transmitted directly to the controller. This includes information on the switching position of the contactor and the motor protection switch, the set nominal current and degree of inertia, motor current and thermal motor utilization. Diagnostic functions for overcurrent, short circuit, overload and phase failure are also available.

Results

For crushing operations, these functions enable the motor load situation to be measured, evaluated and analyzed simply and without additional expense. If a motor protection switch is triggered, personnel are immediately informed that it was triggered and the reason for this, such as overload, for example. Instead of attempting a direct restart under full risk, the responsible employee can specifically check whether any material is jammed on the conveyor belt. Furthermore, the capability exists for appropriate maintenance to be planned in advance if rising current values indicate the motor protection switch is worn. This would prevent the triggering of a protection switch and eliminate drive failure.

"Every drive in Iffezheim is now monitored by SmartWire-DT, so we have valuable information on load factors from the thermal motor image," says Fels. For example, the system enables a gentle start-up of the facility with a low production quantity in its cold state, and a full-load start-up only when the operating temperature is reached. "We know of no other technology that makes it possible for us to achieve this level of transparency in a facility so efficiently and compactly," the automation technology expert adds.

In a crushing operation, the feed material is a naturally fluctuating feedstock that is constantly changing in its composition. This means that at any given time it is possible that the load

on individual systems will vary. For example, if considerably coarser feedstock is added in the first crusher, the end product will be considerably coarser as well. The machines that classify and reject the coarse feedstock after crushing are filled and loaded more heavily; the ones for smaller fractions less so. However, if the feedstock varies, it is accompanied by a change in the load factor of the downstream machines. This makes load-dependent control crucial. The controller decides which component is currently causing a bottleneck by continuously analyzing the load on the individual machine and then directing the power of the entire operation to this unit. A few minutes later it might be a different component that reaches its load limits in the overall crushing operation. The system is then adjusted based on its optimum load-factor capacity. In this way, the new control system ensures that the crushing operation is always performing optimally despite fluctuating conditions.

Thanks to functionalities like load-dependent operation, integrated diagnostics and monitoring and the intuitive operating concept, the crushing operation has been able to reduce unexpected shutdowns and significantly increase the plant's productivity.



Visualization at the control panel is based on a modern touch panel with capacitive multi-touch technology.



Weingärtner's Philip Fels: "Every drive in Iffezheim is now monitored by SmartWire-DT, so we have valuable capacity utilization information on the thermal motor image."



The control station and the electronic technology were shipped in one container so that the crushing operation modernization project could be completed as quickly and smoothly as possible.

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